Patent claims

1. Catalyst for exhaust-gas purification in lean-burn engines, the catalyst comprising at least the following components:

(i) ZrO_2 and/or Ce/Zr mixed oxide as support material, and

(ii) ruthenium as active metal, on its own or together with at least one further active metal selected from the precious metals group.

2. Catalyst according to Claim 1, characterized in that it also comprises at least one rare earth oxide as promoter.

3. Catalyst according to Claim 1 or 2, characterized in that it comprises at least one further transition metal or a further transition metal compound as co-promoter, the transition metal being different from rare earths and precious metals.

4. Catalyst according to one of Claims 1 to 3, characterized in that the ruthenium and, if present, the rare earth oxide are jointly present on the ZrO_2 and/or Ce/Zr mixed oxide.

5. Catalyst according to Claim 4, characterized in that the rare earth oxide and/or the transition metal/transition metal compound and/or the at least one further active metal are likewise at least partially present on the ZrO_2.

6. Catalyst according to one of the preceding claims, characterized in that the at least one further active metal is selected from Pt, Rh, Pd, Re, Os and Ir.

7. Catalyst according to one of the preceding claims, characterized in that the proportion of the sum of ruthenium and all further active metals used relative

to the total quantity of ZrO_2 used is from 0.1% by weight to 5% by weight.

8. Catalyst according to one of the preceding claims characterized in that more than 80% of the zirconium oxide used corresponds to the monoclinic phase.

9. Catalyst according to one of the preceding claims, characterized in that the at least one rare earth oxide is selected from the following group consisting of La oxide, Ce oxide, Pr oxide, Nd oxide, Sm oxide, Eu oxide, Gd oxide, Tb oxide, Dy oxide, Ho oxide, Er oxide, Tm oxide, Yb oxide, Lu oxide, and mixtures or mixed oxides of at least two of the abovementioned oxides.

10. Catalyst according to one of the preceding claims, characterized in that the proportion of the rare earth oxides relative to the total quantity of ZrO_2 is from 2% by weight to 30% by weight.

11. Catalyst according to one of the preceding claims, characterized in that it also comprises an NOx storage component.

12. Catalyst according to Claim 11, characterized in that the NOx storage component is selected from the group consisting of oxides or carbonates of Ba, Sr, La oxide, Pr oxide, Nd oxide, Sm oxide, Eu oxide, Gd oxide, Tb oxide, Dy oxide, Ho oxide, Er oxide, Tm oxide, Yb oxide, Lu oxide, on a porous support oxide.

13. Catalyst according to Claim 12, characterized in that the porous support oxide is selected from Al_2O_3, SiO_2, Al_2O_3/SiO_2 mixed oxide, TiO_2, CeO_2 and Ce/Zr mixed oxide.

14. Catalyst according to one of the preceding claims, characterized in that it is in the form of powder,

granules, extrudate, a shaped body or a coated honeycomb body.

15. Method for purifying the exhaust gas from lean-burn engines in the rich/lean and constant lean mode, characterized in that a catalyst according to one of Claims 1 to 14 is used.

16. Method according to Claim 15, characterized in that the rich/lean mode is realized in alternating rich and lean cycles, with the ratio of the duration of lean cycles to the duration of rich cycles, in normal driving mode, being at least 10:1, and the absolute duration of a lean cycle in normal driving mode being from 10 seconds to 180 seconds.

17. Method according to Claim 15 or 16, characterized in that the exhaust-gas purification comprises the simultaneous oxidation of hydrocarbons and carbon monoxide and the reduction of nitrogen oxides, and optionally also, in the case of diesel engines, the removal of particulates.

18. Method according to one of Claims 15 to 17, characterized in that the lean-burn engine is selected from the group consisting of spark-ignition engines with direct petrol injection, hybrid engines, diesel engines, multi-fuel engines, stratified charge engines and spark-ignition engines with unthrottled part-load operation and higher compression or with unthrottled part-load operation or higher compression, each with direct injection.

19. Method according to one of Claims 15 to 18, characterized in that the catalyst is installed in a position close to the engine or in an underfloor position.

20. Method according to one of Claims 15 to 19, characterized in that an NOx sensor is used to control the rich/lean cycle, and a richer phase is induced precisely when a predetermined NO_x limit value is exceeded.

21. Method according to one of Claims 15 to 20, characterized in that the catalyst according to one of Claims 1 to 13 is used in any desired combination with at least one of the catalysts or filters selected from the following group: starting catalyst, HC-SCR catalyst, NOx storage catalyst, λ-controlled three-way catalyst, particulate filter, soot filter.